be as recommended by the manufacturer.

714.05 Compression Seals Compression seals shall be multi-channel extruded shapes made of material conforming to the requirements of Section 714.01 - Elastomer for Seal Elements, and in a configuration as determined by each particular manufacturer and as shown in the contract documents. The seal shall be marked on the top surface with the manufacturer's name or trademark, the lot number and the size designation at intervals of 1.5 m [5 ft] or less. Actual seal dimensions shall not differ from the nominal dimensions by more than 2 mm per 25 mm [$^{1}/_{16}$ inch/in] of depth or width, or a maximum of 6 mm [¼ in] whichever is less.

The material used shall be one of the products listed on the Maine Department of Transportation's Approved Product List.

714.06 Gland Type Seals Gland type seals shall be single membrane extruded or molded shapes, made of material conforming to the requirements of Section 714.01 - Elastomer for Seal Elements and of a configuration as determined by each manufacturer and as shown in the contract documents. The seals shall be marked on the top surface with the manufacturer's name or trademark, the lot number and the size designation at intervals of 1.5 m [5 ft] or less. If fabric is used to reinforce the seal, it shall conform to the requirements of Section 714.02 - Fabric for Seal Elements.

The material used shall be one of the products listed on the Maine Department of Transportation's Approved Product List.

SECTION 715 - LIGHTING MATERIAL

715.02 Steel Conduit Galvanized steel conduit shall be of uniform thickness with scale-free, smooth circular bore to permit cutting of clean, true threads.

Steel conduit and couplings shall be Schedule 40 galvanized steel pipe conforming to the requirements of ASTM A53. Threaded couplings shall be conduit type permitting the end of conduits to fully abut each other squarely within the coupling. Other fittings for metal conduit, exclusive of bushings shall be threaded malleable iron conforming to the requirements of ASTM A338 and shall be galvanized in accordance with the requirements of ASTM A153.

All bushings shall be threaded, insulated grounding type.

715.03 Non-Metallic Conduit Non-metallic conduit shall be rigid unplasticized polyvinylchloride conduit, suitable for Type II or Type III installations, whichever is required and shall conform to the standards of the NEMA or the UL.

715.04 Prewired Conduit The prewired conduit shall be a unit assembly consisting of the required insulated conductors and neutrals enclosed in a medium or high-density polyethylene duct. The conduit shall be flexible enough for easy coiling or uncoiling at -10°C [15°F]. The duct shall be extruded directly over the paralleled conductors at the factory.

The percent of conduit fill shall be in accordance with the NEC and the UL.

a. Scope: Polyethylene plastic pipe in either medium density or high-density grade, in sizes 19 mm [¾ in] through 63 mm [2½ in] for direct earth burial.

b. Materials:

1. Medium density polyethylene shall meet the applicable requirements as defined in ASTM D1248-70a, Type II, Class C, Category 5 Grade P23.

2. High density polyethylene shall meet the applicable requirements as defined in ASTM D1248-70a, Type III, Class C, Category 5 Grade P34.

3. In addition, the above materials shall meet the requirements as shown below:

Property	Medium Density	High Density	Test Method
Tensile Strength, Minimum MPa [psi]	17.2[2500]	19.3[2800]	ASTM D638M
Elongation, Minimum%	400	400	ASTM D638
Melt Index, Maximum	0.4	0.4	ASTM D1238

Brittle Temperature			
80% Non-failure	-76°C [-105°F]		ASTM D746
Environmental Stress Cracks Resistance, Maximum Failures Per 10 Specimens after 48 Hrs.	2	2	ASTM D1693

The duct shall have dimensions consistent with iron pipe size Schedule 40 conduit. The prewired conduit shall be shipped in continuous lengths on suitable reels.

The wires shall be stranded soft drawn coated copper conductors individually insulated with class THW insulation rated at 75°C [167°F], wet or dry. Insulation thickness shall be 600 volt rated. Phase identification shall be accomplished by numerical coding. Duct size and wire size shall be as indicated on the plans. The wire shall be UL approved.

Terminal connections, splices, and test data requirements shall be as specified in Section 715.07 - Secondary Wiring.

715.05 Metallic Junction and Fuse Box Surface-mounted junction boxes and fuse boxes shall be of either hot-dipped galvanized cast iron or cast aluminum with hinged screw down covers.

Cast iron boxes shall conform to the requirements of Gray and Malleable Iron Castings, Section 713.06. Cast aluminum boxes shall conform to ASTM B108 or ASTM B26/B26M Alloy 356.0.

All boxes shall be furnished with mounting lugs of adequate sizes and threaded bosses properly located and of sufficient thickness to provide a minimum of five full threads for all sizes of conduit used.

Fuse boxes shall be furnished with 5-ampere, cartridge type midget fuses, 10.3 mm [$^{13}/_{32}$ in] in diameter and 38 mm [1½ in] long with 600 volt fuse holder, unless indicated otherwise on the plans. Fuse boxes shall be bossed for fuse holder mounting.

715.07 Secondary Wiring Secondary wiring cables, including neutrals and grounding conductors, shall be 600 volt cables and shall consist of single conductor, stranded, soft-drawn or annealed copper wire, insulated with flame retardant, moisture and heat resistant thermoplastic material. The cable shall be UL approved and listed as THW.

Wire shall be of sufficient size to allow a maximum voltage drop of 5% from source of power to the most remote luminaire. Phase identification shall be made by factory-applied color coding.

Terminal lugs shall be cast copper alloy, solderless, mechanical type.

All conduit connections in above ground junction boxes and light standards shall be made by connector kits, fused or nonfused, as indicated on the plans. Splices for the roadway lighting shall be made by straight through or wye connector kits as required. Where these connector kits cannot be used as verified by the Resident, connections on cables in junction boxes shall be made by splicing as described elsewhere. The connector kits shall be a quick disconnect type. Double connector kits shall be used where there is more than one phase conductor.

Fused "wye" connectors shall be composed of a "wye" line side housing assembled with a load side and fuse terminal housing. The housing shall be formed from water-resistant synthetic rubber. Each housing shall provide a water seal around the cables and when fully assembled shall form a watertight connector.

The interior shall be arranged to receive and retain line side wiring and the fuse contacts. The fuse contacts shall be spring-loaded copper designated for 30 amperes, 600 volts, shall have 90% minimum conductivity and shall be suitable for gripping 5 amperes or as designated on the plans, 600 volt cartridge type midget fuse approximately 10.3 mm [$^{13}/_{32}$ in] in diameter and 38 mm [1½ in] long. The contacts shall be fully annealed. The load side conductors shall be connected by crimping and the line side conductors shall be connected with screws. The connector shall be of the non-locking type that will break off under extreme tensile stress leaving no exposed metal contacts on the line side of the connector.

The cable diameter used will determine the size of each housing. The load side housing shall retain the fuse when disconnected.

Non-fused connectors shall be similar to the fused "wye" connectors. The cable diameter will determine the size of each housing of each connector.

Fuses for connectors shall be rated at 5 amperes or as indicated on the plans.

Underground splices shall be made with cast epoxy splice kits.

715.08 Luminaire, Lamp and Ballast The luminaire shall be designed for the wattage rating and voltage indicated on the plans and for operating on a multiple circuit, using the type of lamps indicated on the plans. All luminaires shall be new and be the product of the same manufacturer.

The luminaire shall be constructed of an aluminum housing and refractor-holder, a refractor-holder latch on the street side and hinge with safety catch on the house side of the luminaire, and a detachable reflector with heat resisting gasketing between the reflector and the socket entry. Luminaires shall mount by a universal slipfitter, which shall clamp onto at least 150 mm [6 in] of a 32 mm to 57 mm [1¼ in to 2¼ in] bracket.

The refractor shall be made of aluminum and finished with prismatic acrylic. For the cutoff optics, a flat glass lens shall be standard except for a dropped clear lexan polycarbonate resin globe for improving the cutoff performance.

Light distribution shall be as shown on the plans and shall conform to ANSI or IES type as specified.

The luminaire shall be supplied with a power factor ballast, of the lag-type regulator capable of operating from a multiple circuit as indicated on the plans. The ballast shall maintain lamp wattage to 6.8% regulation with 1% change in primary voltage variation. Ballast shall provide satisfactory lamp starting and operation to -29°C [-20°F]. The ballast shall be prewired to the lamp socket and terminal board, requiring only connection of the power-supply leads to the ballast primary terminals. The minimum efficiency of the ballast shall be not less than 60%; the power factor not less than 90%.

Lamps shall be of the type and wattage rating indicated below. Lamps used shall conform to the lamp designations as listed in the latest edition of the IES Lighting Handbook.

ANSI & MFG.	LAMP DESIG.	WATTAGE	BALLAST #	LUMENS	LAMP LIFE(HR)
ANSI	MFG.				
	LU50				

S68MS-50	C50S68	50	S68	4000	24000
S62ME-70	LU70 C70S62	70	S62	6000	24000
S54SB-100	LU100 C100S54	100	S54	9500	24000
S55SC-150	LU150/55 C150S55	150	S55	16000	24000
S50VA-250/S	LU250S C250S50/S	250	S50	30000	24000
S52XB-1000	LU1000 C1000S52	1000	S52	140000	24000

The Contractor shall submit shop drawings of the luminaires, lamps, and ballast data.

Underpass or under check luminaires shall be constructed such that the refractor is hinged and can be opened for maintenance. The beam angles shall be field adjustable for, but not limited to, 60° and 70° settings. The ballast shall be integrally mounted, regulator or constant wattage type and designed to operate from a 3 wire 240/480 volt circuit or voltage indicated on the plans.

Pole top luminaires shall be of colonial or traditional design, shall consist of cast aluminum and slipfitter for 75 mm [3 in] outside the diameter of the pole top, and aluminum side posts that are gasketed to the translucent white acrylic lens panels and cast aluminum top housing. The canopy shall be hinged to the lower housing, held closed with two captive screws and gasketed to the lens. In addition, the internal reflector/ refractor assembly shall be gasketed. The ballast shall be prewired to the terminal socket. The luminaire shall be factory painted black.

715.09 Luminaire, Lamp and Ballast for High Mast Lighting The luminaire and ballast shall be designed for the wattage rating and type of lamp shown on the plans.

The maximum weight of the luminaire shall be 48 kg [105 lb] and its projected area shall not exceed 0.29 m^2 [3.1 ft^2].

The luminaire shall be open ventilated design with an optical system consisting of an aluminum reflector. The reflector shall have a smooth, non-porous inner surface and shall be readily attached to the ballast assembly by means of a captive stainless steel nut and machine screw.

The reflector with its aluminum cover shall be firmly attached to a cast ring. This ring shall have keyhole slots in its upper surface such that the reflector/refractor assembly may be readily attached to or detached from the luminaire bracket entry and lamp support assembly without completely removing the support bolts.

The luminaire ballast shall be enclosed within a Number 356 alloy cast aluminum housing which integrally attaches to the luminaire bracket entry and lamp support assembly. It shall be readily removable without removing the luminaire from the bracket arm.

The luminaire shall be attached to the bracket arm by a bracket entry and lamp support assembly. The base for this assembly shall be cast aluminum. The assembly shall include a side entry slipfitter designed for 50 mm [2 in] pipe with provision for +/- 3° adjustment for leveling the luminaire. The lamp shall be vertical burning and prevented from undue vibration and backing out by means of a stainless steel lamp clamp attached to the assembly but separate from the socket. An enclosed terminal block shall be included such that all electrical connections shall be removed from exposure to weather. A stainless steel or aluminum rolled rain shield shall be attached to the outside of this assembly.

All cast aluminum parts of the luminaire shall conform to ASTM B26/B26M or ASTM B108, Alloy 356.0.

The luminaire shall provide ANSI-IES Type I, Type IV, or Type V distributions.

715.10 Photo Electric Control The control shall meet the following minimum requirements:

a. Unit Design The photoelectric unit shall consist of a light sensitive element connected directly to a control relay without intermediate amplifications. The unit shall be zenith sensing type.

b. Housing The photoelectric control shall be housed in a weatherproof housing.

c. Operating Levels The operating levels shall be factory set to turn on at approximately 20 lx [2.0 foot candles] and off at approximately 65 lx [6.0 foot candles].

d. Supply Voltage The control shall be capable of operation on a supply voltage of 105 to 285 volts.

e. Base The base of the unit shall be provided with a 3-prong, EEI-NEMA standard twist lock plug mounting.

f. Directional Design The control shall be oriented in a northerly direction according to the manufacturer's recommendation.

g. Surge Protection The unit shall have a built-in surge protective device for protection from induced high voltage and follow through currents.

715.11 Service Equipment The service pole or service rack and other entrance equipment shall be as detailed on the plans.

The control cabinet shall be fabricated from cast aluminum, sheet aluminum, galvanized steel, or stainless steel. The following are required:

a. Hinged cover with weather protected hasp for padlocking. The lock will be provided by others.

b. Mounting brackets.

c. Suitable bossed and threaded holes in the case wall for conduit installation.

d. Independent single pole magnetic trip circuit breakers.

e. Manual control switch.

f. Lightning arresters in load and line side - rated 650 Volts RMS, indoor type.

g. Contactor - One double pole, single throw mercury solenoid contactor with contacts rated at the voltage and amperes shown on the plans. The coil shall be capable of operating at the voltage shown on the plans, 60 hertz. The contactor shall be normally open unless otherwise specified. The contacts shall be mercury.

h. Ground rods shall be copperclad steel or galvanized, 16 mm [• in] diameter, 2.4 m [8 ft] long, complete with ground clamp and square head bolt.

Dry-Type transformers shall be designed for indoor and outdoor installation. The following are required:

a. 25 KVA rating, 120/240 volt primary, 240/480 volt secondary, single phase 3 wire system, if single phase service is supplied.

b. Frequency - 60 hertz.

c. Key-hole mounting slots and lifting groove.

d. Insulation system for 115°C [239°F] rise at 40°C [104°F] ambient.

e. Wiring compartment located on bottom front of unit. Access through a single cover.

f. Heat barrier to protect connecting cables.

g. Connecting leads to extend 150 mm [6 in] from box and identified with metal tags.

h. Core and coils to be contained within a non-ventilated weatherproof enclosure.

i. Conduit knockouts to be located on bottom, back and sides of wiring compartment.

j. Maximum sound level to be 40 decibels.

Rack-mounted circuit breakers shall be enclosed in NEMA 3R enclosures with rain-tight hubs. The breakers shall be rated for 3 pole, 125 amperes, 600 volt, 4 wire service. Lugs for padlocking shall be supplied.

The service entrance rack shall be constructed as shown on the plan. Minor modifications will be permitted, if approved by the Resident to accommodate variations in equipment dimensions. Lumber shall be as shown on the plan. Bolts and hardware shall be hot-dipped galvanized steel.

715.12 Lowering System for High Mast Lighting Each pole shall be furnished with a mechanical lowering system operated by cables and an electrically operated winch that will permit servicing of the luminaires and associated electrical and mechanical apparatus from the ground. Lowering systems shall permit lowering of the complete assembly, including luminaires, ballasts, fuses, and other apparatus, which may require periodic inspection or servicing, to a height of 1.5 m [5 ft] or less above the pole base plate.

At the top of the pole shaft there shall be mounted a detachable head assembly which remains fixed in position during the raising and lowering operation. The head assembly shall consist of 3 or more symmetrically located fixed support arms, which will carry the weight of the lowering assembly. The fixed head assembly shall incorporate no moving parts except for the necessary pulleys, rollers, or sheaves that guide the lowering cables and electrical cable during the lowering operation of the assembly. The fixed head assembly and luminaire lowering ring shall be galvanized steel. All required pulley rollers or sheaves and associated bearings, bushings and shafts shall be constructed of highly corrosion resistant materials not relying upon plating of the parent material for corrosion protection. All pulleys and rollers attached to the head assembly shall have permanently lubricated bearings or bushings.

All parts of the head assembly shall be protected with covers, screens, shields, as necessary, to prevent entrance of dirt, moisture, ice accumulation, nesting of insects or birds or other contaminants harmful to the operation of the lowering device.

All miscellaneous fittings, fasteners, or hardware shall be fabricated from corrosion resistant materials that do not rely on plating for their corrosion protection.

A lightning rod of approved design shall be attached to the top of each pole and shall be firmly attached to the pole shaft or head assembly to provide good electric bonding to the pole shaft.

The entire luminaire lowering ring assembly shall be raised and lowered by three or more symmetrically placed stainless steel aircraft type cables located inside the pole shaft and extending through the head assembly support arms and attached to the lowering ring. Electrical cable supplying energy from the base of the pole to the luminaire ring shall be rough service mining type cable consisting of 3-600 volt conductors assembled with a messenger into a single cable. No electrical disconnect shall be permitted at the top of the pole. In addition, a stainless steel guide cable or equivalent shall be attached to the inside of the pole shaft to prevent the twisting of the lowering and electrical cables during the raise-lower operation. Each of the stainless steel lowering cables shall be capable of supporting the entire lowering assembly.

When the luminaire ring assembly is in the fully raised position, a mechanism for securing the luminaire ring to the head assembly shall be provided. Such mechanism shall provide support for the lowering ring and shall latch the ring to the head assembly thus permitting the removal of all tension on the cables. All mechanisms shall be designed to provide the operator with a positive means of ascertaining when the raising operation is complete and the ring assembly is in the proper resting position.

The inner portion of the lowering ring shall be equipped with a protective bumper or roller system which will prevent damage to the pole shaft surface and preclude excessive swing during the lowering-raising operation.

Winches shall be operated by an appropriately geared 120 volt electric drive motor with adjustable torque limiter that can be easily hand-transported. One drive motor assembly shall be furnished which will operate all units. The drive motor shall be designed to be readily attached to the pole and/or winch unit and capable of being controlled remotely from at least 6 m [20 ft] from the pole. The drive motor unit shall be equipped with a 480 to 120 volt weatherproof step-down transformer either attached to the drive motor assembly or supplied in a separate enclosure. The transformer shall be of a size compatible with the drive motor and must be adequately grounded to prevent electric shock. A rubber covered heavy-duty type "SO" rated 600 volt cable with connectors shall be provided to test the luminaires when they are in a fully lowered position.

An approved junction box shall be installed in the handhole of each pole that will accommodate the terminations of the underground cable with the cable in the pole serving the luminaires and to include a 480 volt grounded receptacle.

Secondary lightning arresters shall be rated for 650 volts RMS and shall be designed for outdoor use. The arresters shall be installed in each phase conductor to ground and shall be attached in or on the luminaire lowering device in a location accessible for inspection and servicing when the device is lowered.

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SECTION 716 - STRUCTURAL ALUMINUM AND RELATED MATERIAL

716.01 Aluminum Railings

a. Aluminum Extrusions Traffic rails, hand rails, splice bars, and pales brackets shall conform to the requirements of ASTM B221M/B221, Alloy 6061-T6 or 6351-T5. Post and post bases shall conform to the requirements of ASTM B221M/B221), Alloy 6061-T6. Pales shall conform to the requirements of ASTM B429 Alloy 6063-T5. Washers shall conform to the requirements of ASTM B209M/B209), Alloy Alclad 2024-T4.

b. Aluminum Rivets Rivets shall conform to the requirements of ASTM B316M/B316, Alloy 6061-T6 (cold heading). Rivets shall have a button type manufactured head. Self-plugging, aluminum blind fasteners for pale panels shall meet the following requirements: 1) Sleeve-ASTM B211M/B211, Alloy 5056 (Stabilized), 2) Pin - ASTM B211M/B211), Alloy 2017 (Naturally Aged). The driven fastener shall meet the requirements for ultimate shear and tensile strength of Military Specification MIL-R-7885.

c. Miscellaneous Aluminum Parts Rail caps shall be either sand cast or permanent-mold cast and shall conform to the requirements of ASTM B26/B26M or ASTM B108, Alloy A356-T6. All aluminum bars and plates shall conform to the requirements of ASTM B209M/B209), Alloy 6061-T6. Standard structural shapes conform to the requirements of ASTM Specification B308.

d. Steel Anchor Assembly Steel spacers for post anchors shall conform to the